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VACUUM TUBE TRAIN

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Abstract - Vacuum shuttle is a transportation system in which the vehicle is run through evacuated or partly evacuated tubes .There is no need of an engine, here the vehicle is completely controlled externally by using valves. The lack of air resistance could permit to use little power and to move at extremely high speed. This technique may be used to transport passengers or goods. The vacuum inside the tube is produced by using an air compressor .Two rings are provided in between the vehicle and tube to prevent the leakage of air between the two sides .The vacuum tube train is less energy consuming, less time consuming and eco-friendly.

Keywords compressor, transparent tube, capsule, valve, tube holder

I. INTRODUCTION

Speed has become the main factor that everything in the world runs with. It is now the determining factor that how things should be done, how projects are carried out, how things are available for the people to use. Smartphone is the greatest example of the speed factor in our day to day life. Whatever information we require is extracted from internet or any other stored locations using our finger tips. Speed in transport is attained from rails to flights. More developed version of cars and bikes which breaks the speed barrier and sets a new one every time. Hence we practicalise an idea which would beat all the conventional barrier of speed limit. At the beginning of the modern era, ships and trains were the fastest method of travelling. With those people explored and conquered places. Then we learned to fly through long distances in much less time which change the course of history. In the existing scenario the fastest travelling mode is through air. The fastest considered is the North American X-15, which holds the record for fastest manned aircraft (about 7200 km/hr) also there are over hundreds of fast beasts around the world in different countries with similar speed . But it not a common transport mode for regular people but only used for military purpose and all. What we are trying to implement will be the fastest travelling method for all people.

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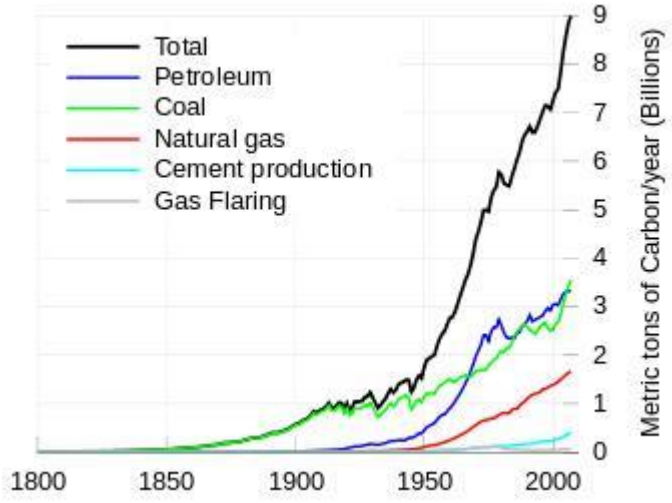
II. METHODOLOGY

We went through a pre-planned methodology. At first we searched about this topic in detail through various sites and made use of the journals and notes that we acquired to propose the working condition of our model device. As the work is fabrication oriented, in the miniature plan and large scale plans are made separately. Then we made a design that would work as the proposed device and by serving some changes we designed another small model which we are going to fabricate. The devices and parts required to build our model is then prepared and merged together to get the designed model

III. WHY VACUUM TUBE TRAIN?

For transportation the entire world is mostly depends on fossil fuels. Fossil fuels are non-renewable resources because they take millions of years to form, and reserves are being depleted much faster than new ones are being made. The production and use of fossil fuels raise environmental concerns. The burning of fossil fuels produces around 21.3billion tones of carbon dioxide (CO_2) per year, but it is estimated that natural processes can only absorb about half of that amount, so there is a net increase of 10.65 billion tones of atmospheric carbon dioxide per year (one tone of atmospheric carbon is equivalent to 44/12 or 3.7 tons of carbon dioxide). Carbon dioxide is one of the greenhouse gases that enhances irradiative forcing and contributes to global warming, causing the average surface temperature of the Earth to rise.



The graph shows global carbon emission by the burning of fossil fuels

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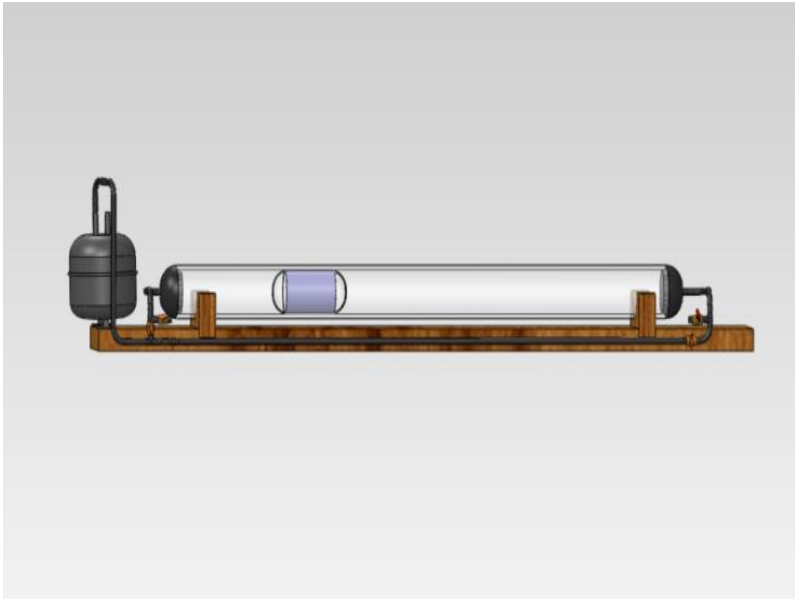
IV. WORKING PRINCIPLE

Vacuum tube train is a modern transportation system which works without the help of an engine. Here the movement of the vehicle takes place inside an evacuated tube and is achieved by the pressure difference between the two sides of the vehicle. Suction is applied to a side which causes the movement of the capsule. The main components used to construct vacuum train are as follows.



Stage 1

Consider the schematic diagram in which the moving object is enclosed in a vacuum cylinder track. At initial condition the moving object is at position A and then a compressor is connected at position B for

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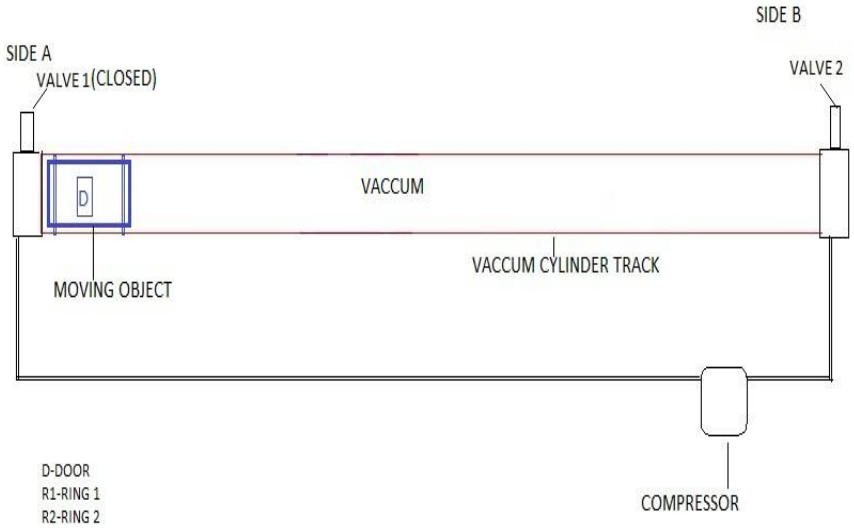
creating vacuum at the right side of the moving object. Initially consider the valve 1 is closed. At that instant the moving object is locked at position A.



Stage 2

After creating vacuum the valve1 is open to allow the atmospheric air enters into the side A. So there produce a pressure difference between two sides of the moving object due to this pressure difference the object starts moving from side A to side B. The speed of this moving object can be regulated by the control valve1.The moving object can stop at any desired position by closing the valve1.Atlast the moving vehicle is reached at side B.

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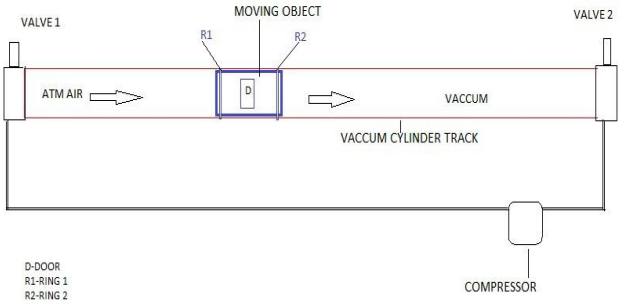
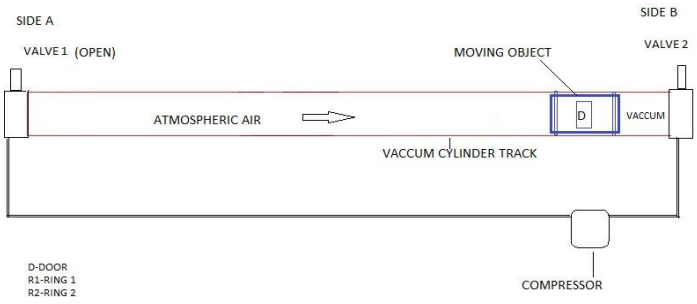


Stage 3

The reverse motion of the vehicle can be achieved by creating vacuum at the left side of the moving object by connecting the compressor at position B. Then as described in stage1 initially consider the valve 2 is closed. At that instant the moving object is locked at position B. After that the valve 2 is open to allow the atmospheric air enter into the side B. Then again there produce a pressure difference between the two sides of the moving object. Due to this pressure difference the object starts moving from side B to side A.



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V. KEY PARTS OF THE PROJECT

SL.NO	COMPONENTS	SPECIFICATION	QUANTITY
1	• Transparent tube	10mm dia 2m length	2
2	• Moving object (vehicle)/Capsule	Length 9.8mm dia 10 cm length	1
3	• Valves		5
4	• Air compressor	With sufficient power	1
5	• Tube holder	Of wood	1

A. *TRANSPARENT TUBE*

The tube is through which the capsule travels. Making it transparent gives us a good view of how the motion occurs inside the transparent tube. Both the ends of the tube are well sealed and there is small gap given for the suction and compression process.

B. *CAPSULE*

It is the running part inside the transparent tube. It is made of some light weight material which is soft on the outside. Which is also well lubricated for the smooth functioning of our model in the big model it is the most important part which includes all the safety measurements for the well-being of the traveller. In the big model. Our train would go very fast maybe up to 5000km/hr . Even on that speed the passenger should be ok without any physical problems. So certain precautions should be taken on it. But in the miniature model it is just a weightless smooth capsule.

C. *VALVES*

Valves are used to control the pressure difference between both sides of the moving object. Speed of the vehicle can be controlled by operating these valves.

D. *COMPRESSOR*

A compressor is used in this mechanism, for suction purpose. A compressor is a mechanical device that increases the pressure of a gas by reducing its volume. An air compressor is a specific type of gas compressor.

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E. TUBE HOLDER

It is a wooden plate on which the holders are fixed, it holds the transparent tube while working, without damaging the tube and preventing any unwanted movement hence to safe guard.

VI. DESIGN AND DEVELOPMENT OF THE PROJECT

In order to design and fabricate anything, there must be some idea, some image, what are the things required all these things should be in the mind and all these ideas should be discussed with the team and make some decisions to build the product. These are the some of the important decisions taken by our team in order to build our model.

The size of the vacuum tube train should be small and the dimensions of the vehicle should be 140cm in length, 11.5 in width. Some standard parts available in the market are used for vehicle building, rather than using customized parts. For base building rectangular cross section wood is used having dimensions of 140 X 11.5cm and thickness of 1cm.In order to get sufficient pressure difference between two sides of the moving object by creating vacuum, a hermetic compressor(refrigerator) is used. For reducing material cost glass tube is used for the making of vacuum cylinder track. As the glass tube is transparent the moving object inside the tube is visible. Control mechanism is kept simple using control valves. A clamp is used to fit the control valves properly into the base. Rubber material, thermocol, sponge, pvc stopper and insulation tape are used at both ends of the tube for creating perfect vacuum inside the tube.

CALCULATION OF ACCELERATION AND VELOCITY

Initial pressure = 1 atm

Final pressure = P initial - ΔP due to compressor

Compressor can be experimentally modelled as

Pt , at any instant t = $C e^{-t/}$

So $\Delta pt = p-pt = p - C e^{-t/}$

$\Delta p \times A$ = driving force

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$(Po - po\ e^{-t/}\ )\times A$

By Considering Laplace Transform,

$Po(L(1-e^{-t/}\ ))\times A=s^2mx+sbx$

CONCLUSION

By the above analysis, transportation problems have been the most serious challenge to human beings. Cars, trains, airplanes and ships are the symbol of modern civilization, but they are also the producers of air pollution, noise pollution, marine pollution, carbon emission and fatal accidents. People worldwide have paid much effort to solve these problems, but the effect isn't ideal. With economic growth, transport dilemma in developing countries became more serious. How to overcome all the above problems and dilemma radically, bringing human beings out from the current dilemma? We can get a significant conclusion: building VTT and having maglev run in the vacuum tube so as to carrying out ultra-speed travel on earth, while reducing energy consumption to least, substantially reducing air pollution and noise, realizing zero emission, and reducing transport casualty accidents by all dimension restrict and high order.

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